Francis Murphy
Critique of ATT/WCOM
Recurring Model

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of Petition of WorldCom, Inc. Pursuant to Section 252(e)(5) of the Communications Act for Expedited Preemption of the Jurisdiction of the Virginia State Corporation Commission Regarding Interconnection Disputes with Verizon Virginia Inc., and for Expedited Arbitration	)	CC Docket No. 00-218
In the Matter of Petition of Cox Virginia Telecom, Inc., etc.	)	CC Docket No. 00-249
In the Matter of Petition of AT&T Communications of Virginia Inc., etc.	)	CC Docket No. 00-251

VERIZON VIRGINIA INC.

VOLUME I OF II

REBUTTAL TESTIMONY OF FRANCIS MURPHY ON THE AT&T/WCOM MODIFIED SYNTHESIS MODEL

(PUBLIC)

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I. INTRODUCTION AND PURPOSE OF TESTIMONY (JDPL ISSUES II-1 TO 11-1-C; II-2 TO II-2-C)

Q. Please state your full name, employer and business address.

A. My name is Francis J. Murphy. I am the President of Network Engineering Consultants, Inc. ("NECI"), located at 5 Cabot Place, Suite #3, Stoughton MA, 02072.

Q. Please describe NECI and the work you perform.

A. NECI specializes in the fields of cost model analysis and development, and network engineering, planning and implementation. I specialize in service cost analysis as it relates to the telecommunications industry. Since founding NECI, I have analyzed and evaluated telecommunications costing methodologies and models involved with Unbundled Network Elements ("UNEs"), Universal Service Fund ("USF") support, non-recurring costs, avoided costs, and collocation cost proceedings. I have also authored expert reports and provided expert testimony on engineering and cost analyses of models filed in numerous state and federal dockets. During the past four years, I have analyzed extensively the various versions of the HAI Model, the Benchmark Cost Proxy Model ("BCPM"), the Hybrid Cost Proxy Model ("HCPM"), the Federal Communications Commission's ("Commission") universal service cost proxy model ("Synthesis Model"),[1] as well as the model sponsored by AT&T/WorldCom in this proceeding ("Modified Synthesis Model").

[1] In the Matter of the Federal-State Joint Board on Universal Service, In the Matter of Forward-Looking Cost Mechanism for High Cost Support for Non-Rural LECs, CC Docket Nos. 96-45 and 97-160, *Tenth Report and Order*, FCC 99-304 (rel. Nov. 2 1999) ("Tenth Report and Order"); In the Matter of Federal-

My work with these models has included an evaluation of each model's platform and inputs as they were used in different applications including federal USF, state USF, and state UNE cost studies. The fundamental, but distinct difference in requirements for each of these applications, has provided me with a general understanding of the Commission's Orders and court decisions relating to each model's different requirements.

Q. Please summarize your educational background and employment experience prior to founding NECI.

A. I have worked in the telecommunications industry for more than 30 years. Prior to founding NECI, I worked for Financial Strategies Group on behalf of its client, Pacific Bell, in the California Public Utilities Commission's "OANAD" proceeding relating to Pacific Bell's avoided cost studies. Earlier in my career, I worked in the telecommunications industry at NYNEX for over 25 years. While at NYNEX, I held various positions in the Network Operations, cost analysis, marketing, and access services divisions.

I received a Bachelor of Arts degree in Business Management from Boston College in 1986. I have also attended numerous technical, management and service cost-related courses, including Bellcore (now "Telcordia") sponsored

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State Joint Board on Universal Service, In the Matter of Forward-Looking Mechanism for High Cost Support for Non-Rural LECs, CC Docket Nos. 96-45 and 97-160, *Fifth Report and Order*, FCC 98-279 (rel. Oct. 28, 1998) ("Fifth Report and Order").

service cost development and separations and settlement courses. My complete curriculum vitae is set forth in Attachment 1 to my testimony.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to respond to the pre-filed direct testimony of Mr. Brian Pitkin, Ms. Catherine Pitts, Mr. Joseph Riolo, Mr. Steven Turner, and Mr. Richard Walsh filed on behalf of AT&T Communications of Virginia, Inc. ("AT&T") and WorldCom, Inc. ("WorldCom") (collectively, "AT&T/WorldCom") dated July 31, 2001. I will show why, based on my detailed analysis, the Modified Synthesis Model is not appropriate for calculating Verizon Virginia Inc.'s ("Verizon VA") forward-looking costs of providing UNEs in Virginia. I will also show that the platform and input adjustments made by AT&T/WorldCom to the Synthesis Model are improper, incorrect, and unsupported, thereby further distorting UNE cost relationships and understating UNE cost estimates.

Q. Do other Verizon VA witnesses address on AT&T/WorldCom's cost model and inputs?

A. Yes. Dr. Timothy Tardiff of National Economic Research Associates, Inc. addresses significant economic and modeling flaws identified during his examination of the Modified Synthesis Model. In certain instances my testimony and Dr. Tardiff's testimony discuss similar aspects of the Modified Synthesis Model, with my testimony focusing on the Model's engineering and operational

shortcomings, and Dr. Tardiff's focusing on the Model's failure to adhere to basic economic and modeling principles. In addition, Dr. Howard Shelanski addresses the economic principles for determining the forward-looking costs of providing UNEs, Dr. James Vander Weide addresses the appropriate cost of capital that should be used in a cost study, and Mr. Allen Sovereign addresses the appropriate economic lives and salvage values that should be applied.

Q. Please summarize the main points of your testimony.

A. As explained more fully herein, the Synthesis Model was designed solely to support the federal USF program. It was not designed or approved by the Commission to develop intrastate USF calculations, much less estimate company-specific, forward-looking costs of providing UNEs. Indeed, the Commission noted that, by adopting the Synthesis Model, it was "not attempting to identify any particular company's cost of providing supported services."[2]

In an effort to remedy what they see as the obvious model deficiencies and to substantially reduce cost estimates, AT&T/WorldCom made significant changes to the Commission's cost model platform and input values, thus producing the so-called "Modified Synthesis Model." However, AT&T/WorldCom's changes fail to adhere to widely-accepted engineering practices and deviate significantly from appropriate cost modeling techniques. In

[2] Tenth Report and Order at ¶ 162.

essence, AT&T/WorldCom's attempting to fix the Synthesis Model exacerbated existing model flaws, which result in distorted and understated costs estimates.

Specifically, the Modified Synthesis Model sponsored by AT&T/WorldCom contains numerous and serious platform and input flaws that cause it to severely underestimate Verizon VA's or any other efficient carrier's forward-looking costs. Furthermore, the Synthesis Model and the Modified Synthesis Model incorporate engineering design parameters that do not adhere to widely-accepted industry practices and, as a result, model an unrealistic network that could not support the level of customer demand, the types of services, and service quality standards that Verizon VA or any efficient carrier in the real world must accommodate. Tellingly, most of AT&T/WorldCom's modifications have never been approved or adopted by the Commission or any state public service commission. In fact, the only state public service commission to consider a number of AT&T/WorldCom's modifications rejected them.[3]

Moreover, the Synthesis Model, as well as AT&T/WorldCom's Modified Synthesis Model, cannot be fully evaluated and tested. They rely on an outdated programming language, and combine nationwide and state-specific inputs in a manner that is inconsistent with the Model's algorithms and do not reflect Verizon VA's (or any other real company's) operating realities.

[3] Before the Georgia Public Service Commission, Docket No. 5825-U, Phase II, *Order* (Dec. 19, 2000) ("Georgia Order").

Not surprisingly, as the examples below demonstrate, the Modified Synthesis Model's platform and input flaws, as well as its combination of nationwide and allegedly state-specific inputs, produce unrealistic and significantly understated cost estimates. The following list of these flaws is by no means exhaustive:

- The Modified Synthesis Model ignores industry standard loop planning and sizing guidelines, and thus builds insufficient distribution plant to accommodate demand peaks and fluctuations, customer churn, unoccupied housing units, and maintenance needs. In doing so, the Model produces a network that is unable to meet the service quality standards required by the Virginia State Corporation Commission ("Virginia Commission") and expected by Virginia consumers.

- The Modified Synthesis Model improperly assumes that all high-speed services are provisioned on copper loops, despite the fact that some high-speed services (i.e., DS-3 services) can only be provisioned over coaxial or fiber optic cable. Equally absurd is the Model's failure to provision any of the electronic multiplexing equipment necessary to enable these high-speed services to function.

- The Modified Synthesis Model includes only a small fraction of the Digital Cross Connection System ("DCS") investment required to allow the Synchronous Optical Network ("SONET") ring architecture used in the Model to function. By ignoring over $645 million dollars in DCS investment, the Modified Synthesis Model builds an interoffice network is not able to transport calls.

- The Modified Synthesis Model lacks the ability to include special access circuits in the network. Mr. Pitkin's exaggerated loop demand does not compensate for the Model's lack of sophistication to include these circuits, but rather introduces additional errors into the Model. Because of its inability to include DS-1 and DS-3 circuits, the Modified Synthesis Model fails a number of basic total element long run incremental cost ("TELRIC") costing principles.

- AT&T/WorldCom's reduction of the road factor from 1.0 to 0.9 is inappropriately based on a comparison of the embedded cable sheath miles in ***Kansas***. To claim that this reduced road factor value is Virginia-specific is ridiculous. If AT&T/WorldCom had compared the Verizon VA cable sheath miles in ARMIS with the sheath distance calculated by the Model, it would have found that the Modified Synthesis Model generates

less than 85 percent of the cable sheath miles in Virginia, and thus the road multiplier should have been increased, not decreased.

As a result of these and other errors, the Modified Synthesis Model produces the following absurd results:

- The Model estimates an average drop length of only 24 feet -- 50 percent shorter than the average length estimated by the Synthesis Model, and one-third of the average drop length estimated in a national study.

- The Model builds outside plant to only 5,575 distribution areas, despite the fact that there are actually 11,500 distribution areas in Verizon VA's network.

- The Model's inappropriate treatment of special access services understates the estimated loop costs by an extraordinary 50 percent.

- The switch line growth rate (forecasted demand) reflected by the Model is over 4 times greater than the growth rate realized by Verizon in the year 2000.

- The growth rate of call usage ("DEMs") reflected in the Model is nearly two times greater than the amount experienced by Verizon in the year 2000.

Any cost model of this type used by the Commission to calculate UNE costs should adhere to the appropriate TELRIC cost methodology, account for all UNEs, be free of major platform flaws, and be based on realistic and appropriate engineering standards. As discussed more fully below, the Synthesis Model, with or without AT&T/WorldCom's adjustments, does not meet these requirements; it was not designed, and cannot be modified, to estimate accurately the forward-looking costs of any efficient telecommunications provider operating in the real world. As a result, neither the Synthesis Model nor the Modified Synthesis Model should be used to calculate Verizon VA's forward-looking cost of providing UNEs.

Q. Can the network design employed by the Modified Synthesis Model be used to build a functioning telephone network in Virginia?

A. No. The Modified Synthesis Model platform assumptions and design criteria, as well as the selection of inputs, do not reflect realistic and reasonable considerations or accepted engineering standards. In fact, the only consistency in the Model's input assumptions and design criteria is that they improperly decrease the cost outputs of the Model.

- A functioning network must be able to provide all the high-speed special access services (e.g., DS-1 and DS-3 services) and digital data services (e.g., ISDN integrated services digital network ("ISDN") and digital data service ("DDS") available and demanded today. The network design employed by the Modified Synthesis Model is not able to provision the most basic of these services.

- A functioning network must be able to switch calls between all the central offices and to and from other carriers. The network design employed by the Modified Synthesis Model does not provide the equipment necessary to transport calls between the central offices and to interconnect with other carriers.

- A functioning network must be able to meet existing customer demands for new services and new customer demands for any service offerings in a reasonable time frame. The network design employed by the Modified Synthesis Model does not have sufficient capacity to respond in a reasonable time frame to any growth requirements or new demands.

These are only a few of the reasons the network modeled by the Modified Synthesis Model cannot be used to build a functioning telephone network in Virginia.

Q. What would be the result if a network were built to conform with the design criteria and assumptions in the Modified Synthesis Model?

A. Simply put, it would not work. There would be insufficient cable to reach in-service customer premises and no facilities available to serve new customer premises. Drop wires would typically extend onto customer premises but not for enough to reach the buildings where the customers are located. Customers would experience slow dial tone and frequent delays and busy signals during periods of increased call volumes. The interoffice transport network would not function. In other words, the absence of essential equipment would prevent calls from being transported from one central office to another. Moreover, the Model does not contain sufficient investment in power equipment to operate the switches and circuit equipment. Carrier orders for local or interoffice facilities could not be filled in a timely manner, as new facilities would have to be installed to meet the new demand. New customers moving into empty or new housing units would have to wait months to receive service. Local streets and sidewalks would continually be subjected to construction crews digging up surfaces or installing new cables to reach unoccupied and new housing units. Local ordinances to limit new construction to "out-of sight" underground and buried structure would be violated as substantial amounts of aerial structure were deployed.

II. THE SYNTHESIS MODEL WAS NOT DESIGNED TO ESTIMATE FORWARD-LOOKING UNE COSTS (JDPL ISSUES II-1 TO 11-1-C; II-2 TO II-2-C)

Q. Which versions of the Synthesis Model and Modified Synthesis Model did you analyze for purposes of this testimony?

A. My analysis focused on AT&T/WorldCom's Modified Synthesis Model submitted to the Commission on July 2, 2001. Because the foundation of AT&T/WorldCom's Model was the January 20, 2000 release of the Synthesis Model, I also included this version of the Synthesis Model in my analysis. I obtained the Synthesis Model from the "install.zip" file found on the Commission's Internet site, www.fcc.gov/ccb/apd/hcpm/.

Q. Was the Synthesis Model designed to develop forward-looking UNE costs?

A. No. The Commission specifically stated that its model was designed solely to support the federal USF program and cautioned parties not to make other claims regarding its use in determining state universal service support or forward-looking costs for UNEs.[4]

In the Fifth Report and Order, the Commission explicitly alerted parties to the fact that it had not evaluated the Synthesis Model for any purpose other than

[4] Tenth Report and Order at ¶ 31, fn. 416.

national USF cost calculations.[5] Again, in the Tenth Report and Order, the Commission made it clear that:

> The federal cost model was developed for the purpose of determining federal universal service support, and it may not be appropriate to use nationwide values for other purposes, such as determining prices for unbundled network elements. We caution parties from making any claims in other proceedings based upon the input values we adopt in this Order.[6]

The Commission reiterated this position several months ago when it stated:

> The Commission has never used the USF cost model to determine rates for a particular element, nor was it designed to perform such a task. The model was designed to determine relative cost differences among different states, not actual costs. That is the purpose for which the Commission has used the model in the universal service proceeding. [7]

Contrary to Mr. Pitkin's assertions, the Synthesis Model was not intended, and cannot properly be used for the purposes proposed by AT&T/WorldCom[8] -- it cannot develop reliable UNE cost estimates. AT&T/WorldCom's modifications merely exacerbate the problem, producing cost estimates that are significantly understated and inappropriate for state UNE purposes.

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[5] Fifth Report and Order at ¶ 12.

[6] Tenth Report and Order at ¶ 32 (emphasis added).

[7] In the Matter of Application of Verizon VA New England, Inc., Bell Atlantic Communications, Inc. (d/b/a Verizon VA Long Distance), NYNEX Long Distance (d/b/a Verizon VA Enterprise Solutions) And Verizon VA Global Networks Inc. for Authorization to Provide In-Region, Inter-LATA Services in Massachusetts, CC Docket No. 01-9, *Memorandum Opinion and Order*, FCC 01-130 (rel. April 16, 2001) at ¶ 32 (emphasis added).

[8] Before the Federal Communications Commission, CC Docket Nos. 00-218, -249, -251, *Direct Testimony of Brain F. Pitkin* (July 31, 2001) at pgs. 2-3 ("Pitkin Direct Testimony").

Q. Are there other reasons why the Synthesis Model is inappropriate for developing UNE costs?

A. Yes. The Synthesis Model platform and inputs were adopted as an expedient approach to identifying the relative differences among states regarding the costs of providing certain narrowly-defined services supported by the federal USF mechanism.[9] In contrast, the Commission in its local competition orders required carriers to provide UNEs that would support a much broader range of services.[10]

As I will demonstrate, there are a number of USF-specific assumptions and factors that render the Synthesis Model incapable of accurately identifying the cost of providing UNEs in Virginia in accordance with TELRIC standards. First, UNEs, as defined by the Commission, differ from the elements that comprise the core USF services. The unbundling requirements and the definitions of UNEs have evolved over time in orders issued before, as well as after, the Commission's definition of the core services supported by the federal USF mechanism. More importantly, TELRIC standards require that the cost of each UNE reflect: (1) the total quantity of facilities and functions that are directly

[9] 47 C.F.R. § 54.101. Services designated for support include: single party (or functional equivalent), voice grade access (minimum bandwidth 300 to 3,000 Hz) to the public switched network, local usage (undefined amount provided free), dual tone multi-frequency signaling (or equivalent), access to emergency services, operator services, inter-exchange service and directory assistance, and toll limitation for qualifying low-income consumers.

[10] 47 C.F.R. § 51.505(b). "The total element long-run incremental cost of an element is the forward-looking cost over the long run of the total quantity of the facilities and functions that are directly attributable to, or reasonably identifiable as incremental to, such element, calculated taken as a given the incumbent LEC's provision of other elements."

attributable to such element; (2) the most efficient technology currently available; and (3) a reasonable allocation of forward-looking common costs.[11] In addition, the Synthesis Model relies on inappropriate engineering standards and principles, and uses national rather than state or company-specific input values. Put simply, the Synthesis Model's platform and inputs, as well as those of the Modified Synthesis Model, do not meet these TELRIC requirements for UNEs and cannot develop accurate UNE cost estimates.

Q. Did you evaluate the impact of AT&T/WorldCom's input changes on plant investment?

A. I have analyzed AT&T/WorldCom's specific input changes that affect items such as structure sharing and plant mix. Although seemingly innocuous individually, each of the changes substantially reduce plant investment as shown below.

[11] 47 C.F.R. § 51.505.

TABLE 1
Effect of AT&T/WorldCom Input Value Changes[12]

AT&T/WorldCom Input Value Change	Total Plant Investment Reduction
Road Factor Reduction	$107.6 million
DLC Cost Reduction	$98.7 million
Structure Sharing Adjustment	$293.4 million
Plant Mix Adjustment	$364.9 million

As I will describe later, AT&T/WorldCom's changes also affect plant investment in other ways, such as a 50 percent reduction in the drop length, even though there is no specific drop length input to the Modified Synthesis Model. Costs are also affected by the Modified Synthesis Model's failure to properly engineer interoffice facilities ("IOF"). For example, SONET investment is understated by up to $784 million.

Moreover, the Modified Synthesis Model cannot be corrected by restoring the input values to their default levels. The Synthesis Model and the Modified Synthesis Model proffered by AT&T/WorldCom contain serious methodological problems and are incapable of estimating Verizon VA UNE costs. Dr. Tardiff demonstrates in his rebuttal testimony the dramatic effect that AT&T/WorldCom's input changes have on the Modified Synthesis Model's loop cost estimates.

[12] The values in Table 1 were determined by using the Modified Synthesis Model inputs as proposed by AT&T/WorldCom as the base run. Each of the inputs were then set back to the default value one at a time and the Modified Synthesis Model was run to determine the impact of that single input change. This process was repeated for each value except for Plant Mix, which was the difference between two separate runs of the Model. Because the input values are interrelated, the total effect of each change will differ from the sum of the individual changes. The change in loop costs referred to later in my testimony is also the result of each of these Model runs.

III. THE MODIFIED SYNTHESIS MODEL PLATFORM IS FUNDAMENTALLY FLAWED (JDPL ISSUES II-1 TO 11-1-C; II-2 TO II-2-C)

Q. Is the Modified Synthesis Model susceptible of a complete analysis?

A. No. It is difficult to analyze the assumptions and algorithms underlying the Modified Synthesis Model because the source code for the feeder and distribution modules of the Model is written in Turbo Pascal and compiled in various ".exe" files. Turbo Pascal is no longer commercially available.[13] Therefore, absent an old copy of the software, the source code cannot be changed and recompiled to conduct a complete and meaningful evaluation of the Modified Synthesis Model or a thorough validation of AT&T/WorldCom's coding changes. In essence, AT&T/WorldCom is asking the parties and the Commission to accept that their assertions are correct without testing the validity or accuracy of their source code changes.[14] Dr. Tardiff addresses additional software-related difficulties he encountered in evaluating the Model.

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[13] *See* Borland Software Corporation's web page for Turbo Pascal at http://www.borland.com/pascal.

[14] In recognition of the difficulties associated with reviewing the model, the Commission recently rewrote portions of the Synthesis Model in Delphi, a programming language intended to replace Turbo Pascal. "In an effort to use a computer language that works best for the Commission and all interested parties, this Public Notice seeks comments on advantages of the Delphi version over the Turbo-Pascal version, and recommendations concerning improvements to the Delphi version." Before the Federal Communications Commission, DA 01-1458, *Common Carrier Bureau Seeks Comment on Translation of Cost Model to Delphi Computer Language and Announces Posting of Updated Cost Model* (June 20, 2001).

A. Loop Module

1. Definition Of A Loop

Q. What outside plant items comprise the loop?

A. The outside plant ("OSP") items that comprise the loop and its components include the local loop, subloop, line conditioning[15] and network interface device ("NID"). The Modified Synthesis Model's loop module definition of these components, with a few significant exceptions, reflects the definition established by the Commission in the First Report and Order.

Q. How was the local loop element defined in the Commission's First Report and Order?

A. The local loop element was defined in the Commission's First Report and Order as:

> . . . as a transmission facility between a distribution frame or its equivalent, in an incumbent LEC central office, and the network interface device at the customer premises. This definition includes, for example, two-wire and four-wire loops that are conditioned to transmit the digital signals needed to provide services such as ISDN, ADSL, HDSL and DS-1 level signals.[16]

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[15] The Commission ordered that Line Conditioning costs be recovered as a non-recurring cost, and therefore line conditioning costs are not identified by the Modified Synthesis Model. In the Matter of Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, CC Docket No. 96-98, *Third Report and Order and Fourth Further Notice of Proposed Rulemaking*, FCC-238 (rel. Nov. 5, 1999) at ¶ 194.

[16] In the Matter of the Local Competition Provisions of the Telecommunications Act of 1996, In the Matter of Interconnection between Local Exchange Carriers and Commercial Mobile Radio Service Providers, CC Docket Nos. 96-98 and 95-185, *First Report and Order*, FCC-325 (rel. Aug. 8, 1996) at ¶ 380 ("First Report and Order").

In defining the loop this way, the Commission not only specified the physical nature of the loop, but also defined the loop in terms of its capability to deliver specific types of services.

Q. What are the current Commission definitions of the local loop, subloop, line conditioning, and network interface device elements?

A. The Commission's unbundling rules further defined the loop, and other elements that comprise it, including the subloop, line conditioning, and network interface device as:

> The local loop network element is defined as a transmission facility between a distribution frame (or its equivalent) in an incumbent LEC central office and the loop demarcation point at an end-user customer premises, including inside wire owned by the incumbent LEC. The local loop network element includes all features, functions, and capabilities of such transmission facility. Those features, functions, and capabilities include, but are not limited to, dark fiber, attached electronics (except those electronics used for the provision of advanced services, such as Digital Subscriber Line Access Multiplexers), and line conditioning. The local loop includes, but is not limited to, DS-1, DS-3, fiber and other high capacity loops.[17]

> The subloop network element is defined as any portion of the loop that is technically feasible to access at terminals in the incumbent LEC's outside plant, including inside wire. An accessible terminal is any point on the loop where technicians can access the wire or fiber within the cable without removing a splice case to reach the wire or fiber within. Such points may include, but are not limited to, the pole or pedestal, the network interface device, the minimum point of entry, the single point of interconnection, the main distribution frame, the remote terminal, and the feeder/distribution interface.[18]

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[17] 47 C.F.R. § 51.319(a)(1).

[18] 47 C.F.R. § 51.319(a)(2).

> Inside wire is defined as all loop plant owned by the incumbent LEC on end-user customer premises as far as the point of demarcation....[19]
>
> Line conditioning is defined as the removal from the loop of any devices that may diminish the capability of the loop to deliver high-speed switched wireline telecommunications capability, including xDSL service.[20]
>
> The network interface device network element is defined as any means of interconnection of end-user customer premises wiring to the incumbent LEC's distribution plant, such as a cross-connect device used for that purpose.[21]

In these rulings, the Commission moved away from narrowly defining loops to provision a limited range of services for federal USF purposes, and instead adopted an expanded definition that requires UNE loops to support a much broader range of services.

Q. Please explain why the USF requirements reflected in the Modified Synthesis Model's loop module cannot produce TELRIC-compliant UNE costs.

A. The Modified Synthesis Model is incapable of accurately determining the costs for all components of the loop as defined by the Commission (such as fiber loops, subloop-distribution and subloop-feeder). For those elements of the loop that the Modified Synthesis Model is capable of developing cost estimates, the cost

[19] 47 C.F.R. § 51.319(a)(2)(i).

[20] 47 C.F.R. § 51.319(a)(3)(i).

estimates are incorrect because the Model fails to use forward-looking engineering standards and fails to apply proper costing criteria. In addition, the Model is incapable of modeling a loop that is able to support the wide-range of services required, including dark fiber, ISDN, DDS, DS-1, and DS-3.

2. Loop Design, Engineering And Quality Of Service Issues

Q. Does the Modified Synthesis Model adhere to Carrier Serving Area loop design standards?

A. No. The Modified Synthesis Model does not adhere to Carrier Serving Area ("CSA") loop design standards, which limit the use of copper loops to 12,000 feet beyond the feeder/distribution interface and enable Verizon VA to support a wide range of digital services. In developing the Synthesis Model for its national USF program, the Commission abandoned the CSA standard, thereby causing the Synthesis Model to design plant that may be incapable of supporting many services currently offered over basic loops (i.e., a modem speed greater than 28.8 kbs, ISDN, DDS) and will introduce inefficiencies in incumbent local exchange carrier ("ILEC") provisioning processes. This standard is not forward-looking since it is not capable of efficiently provisioning the services that the Commission uses to define a loop. Analog modems, BRISDN, and DDS were designed to work within the CSA loop standards. Any deviation from these standards could prevent the delivery of these services and would introduce inefficiencies in the incumbent carrier's operations. Attachment 2 describes how the CSA loop design standards evolved over time.

[21] 47 C.F.R. § 51.319(b).

Q. Does the failure to adhere to appropriate industry engineering guidelines for designing the OSP network have a significant impact on the loop cost estimates of the Modified Synthesis Model?

A. Absolutely. Verizon VA has over 11,500 distribution areas in its network, but the Modified Synthesis Model develops only 5,575 serving areas.[22] Although the estimate of 5,575 distribution areas is severely understated, it would have been even lower were it not for the use of the inflated line count. The Modified Synthesis Model's understatement of distribution areas by approximately 51 percent is the result of its failure to support the industry distribution CSA loop design standard, and as I will discuss, failure to account for vacant residential and business units, to adhere to accepted industry engineering practices when building OSP, and to exercise sound economic judgment when designing the feeder and distribution networks. These infirmities highlight the fundamentally flawed, theoretical nature of the Modified Synthesis Model. The significant understatement of the distribution plant investment per-unit, due to overstated demand, unattainably high utilization, low structure costs, fewer distribution areas and too little length of cable, causes the Modified Synthesis Model to produce an unreasonably low estimate of the cost of provisioning adequate loop plant.

[22] For purposes of this analysis, I will refer to Model serving areas, or clusters, rather than distribution areas because the Model does not provide detailed outputs for distribution areas. This approach is used because the difference between the number of distribution areas (equivalent to the Serving Area Interfaces (SAIs)) and clusters is minimal. While the Modified Synthesis Model can establish as many as two distribution serving areas per cluster, it generates 5,575 clusters and 5,652 SAIs (distribution areas) (about 1 percent more distribution areas than the number of clusters).

Q. Why did the Commission adopt a cost model that does not adhere to forward-looking loop design standards?

A. The Commission adopted the Synthesis Model for the national USF mechanism and found "that the public interest would not be served by burdening the federal universal support mechanism with the additional cost necessary to support a network that is capable of delivering very advanced services."[23] Thus, in the USF context, the Commission was content to model a network that ignored the need to provide all services that Verizon VA's network is designed to provide, including, ISDN, DDS, DS-1, DS-3 and dark fiber. As a result, AT&T/WorldCom's Modified Synthesis Model is not capable of modeling the type of network needed to provide all of these services.

Q. Does the Modified Synthesis Model adhere to accepted loop planning standards and guidelines?

A. No. The Modified Synthesis Model fails to adhere to industry standard loop planning and sizing guidelines that recommend building sufficient distribution plant to accommodate subscribers' needs for multiple lines, demand fluctuations (also called "churn") and growth. For example, Lucent Technologies' "Outside Plant Engineering Handbook" recommends, as the standard for allocating distribution cable pairs, 2 pairs per potential residential living unit and 5 pairs per

[23] Fifth Report and Order at ¶ 70.

potential business for small business areas.[24] Verizon VA's distribution facilities have been built according to industry guidelines and Verizon VA's cost study includes sufficient distribution facilities to meet the needs of customers. The Modified Synthesis Model ignores accepted industry practices and, as a result, models loop plant with insufficient capacity to meet current and future demand needs.

Q. Does the Synthesis Model follow a stringent loop plant sizing standard for USF purposes?

A. No. The Commission, in the Tenth Report and Order, recognized that companies build distribution plant to "ultimate demand," but rejected this practice, in part, because of the burden that it placed on the USF mechanism.[25] However, by ignoring industry-accepted OSP planning guidelines when costing UNEs, the Synthesis Model, and by default the Modified Synthesis Model, effectively allow competitors to utilize services for which they have inadequately compensated Verizon VA.

[24] Lucent Technologies, "Outside Plant Engineering Handbook" (Oct. 1996) Interfaced Cable Sizing Guidelines at pgs. 3-11. This Handbook was originally prepared and published by AT&T and is now published by Lucent as a result of the corporate separation.

[25] Tenth Report and Order at ¶ 199.

Q. Does the Modified Synthesis Model further understate OSP investment by ignoring vacant residential and business units?

A. Yes. Year 2000 Census Bureau statistics for Virginia show that approximately 205,000 housing units (or approximately 7.1 percent of all housing units) were vacant at the time of the census. Of these, 150,300 (or 73.3 percent) are classified as year-round use.[26] A significant number of housing units are vacant pending rental turnover or real estate transfer. Tenants and buyers generally expect to have telephone service at their new location at or near the time of occupancy, particularly when the space was previously occupied.

Furthermore, in designing and placing OSP facilities, engineers must also consider existing vacant lots that are potential building sites as well as zoning laws that regulate building occupancy. In a neighborhood of multi-family homes, it is appropriate to engineer the OSP to the expected level of occupancy, even though the living units might be occupied by fewer families than zoning regulations permit.[27] By ignoring these real-world costs associated with vacant residential and business units, the Modified Synthesis Model is able to artificially decrease UNE cost estimates.

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[26] United States Census Bureau 2000 General Demographic Characteristics (Table DP-1) for Virginia.

[27] AT&T/WorldCom stated in response to Verizon VA's Third Set of Data Requests to AT&T and Fourth Set of Data Requests to WorldCom, Request No. VZ-VA 53, that the Model includes some unoccupied housing units since the customer locations data is based, in part, on an address database for mass mailings. As with AT&T/WorldCom's other assertions, there is no quantitative or documented support for this claim or the amount of vacant housing allegedly covered by the mailing list. It is also improbable that the database referred to by AT&T/WorldCom sent mailings to vacant lots.

Q. Does the Modified Synthesis Model adhere to widely-accepted engineering standards in sizing the feeder and distribution networks?

A. No. Widely-accepted engineering standards call for maximizing the length of the feeder segment of a local loop to take advantage of the inherent efficiencies in feeder plant. The Modified Synthesis Model fails to adhere to these standards by using a smaller number of clusters (i.e., surrogate distribution areas) than would be used in an optimally-designed network. This smaller number of clusters produces shorter feeder segments between the distribution areas and the central office.

Q. Why is it efficient to maximize the feeder segment of the loop?

A. Feeder facilities can be operated at higher utilization levels than distribution facilities because feeder facilities serve larger groups of subscribers and experience less variability in demand. Widely-accepted engineering standards and sound economic reasoning account for this by maximizing the length of the feeder portion of loops and minimizing the length of the distribution portion.

Q. How does the Modified Synthesis Model's failure to maximize the feeder segment of the loop impact the Model's loop cost estimates?

A. The Model's failure to maximize the length of feeder facilities produces lower total costs of feeder plant in the Model's hypothetical network. Rather than reflect all of the added costs of distribution facilities associated with the Model's inefficient design, the Model instead greatly understates the amount of

distribution facilities necessary to serve existing customers. This combination of an inefficiently small amount of feeder facilities and an impossibly small amount of distribution facilities substantially understate the loop investments necessary to serve Verizon's VA's customers.

Q. Does the Modified Synthesis Model adhere to service quality standards imposed by the Virginia Commission?

A. No. The Virginia Commission's service quality standards require Verizon VA to complete orders for new service within certain specified time frames.[28] Operational efficiency dictates that facilities remain in place when housing and business units are temporarily unoccupied. However, because lines to vacant housing and business units are not reported in ARMIS, the Modified Synthesis Model fails to account for them when developing the OSP network UNE cost estimates. As a result, the Model could not possibly meet the service quality standards expected by the Virginia Commission. Furthermore, the Synthesis Model fails to conform to basic engineering practices or reflect sound economic judgment in designing the network, and thereby drives up the cost of provisioning new services to Virginia consumers because of the inefficiencies resident in the Synthesis Model's network.

[28] 20 VAC 5-400-800.

3. Unbundling Digital Loop Carrier

Q. What assumptions does the Modified Synthesis Model make about fiber-fed digital loop carrier ("DLC") loops?

A. The Modified Synthesis Model assumes that all fiber fed DLC loops will be provisioned utilizing the GR-303 integrated digital loop carrier ("IDLC") switch interface, and it further assumes that it is technically feasible to unbundle such loops.

Q. Is it technically feasible and cost-effective to provide access to unbundled loops served with the GR-303 IDLC interface?

A. No. As the Verizon cost panel explained, industry standards and technical interfaces need to be developed to support using GR-303 in a multi-carrier environment.[29] Remote terminal ("RT") suppliers would also have to develop additional security, error-detection, and other capabilities necessary to support the use of the same RT and central office terminal ("COT") by multiple carriers. This required technology is not presently available.

[29] Before the Federal Communications Commission, CC Docket Nos. 00-218, -249, -251, *Verizon Virginia Inc. Panel Testimony on Unbundled Network Element and Interconnection Costs* (July 31, 2001) at pgs. 90-93 ("Verizon VA's Cost Panel Testimony").

Q. Does AT&T/WorldCom's alleged solution to unbundling GR-303 IDLC capture all applicable costs?

A. No. Apart from the technical problems associated with a multi-carrier IDLC environment, the Modified Synthesis Model does not determine all appropriate costs that would be incurred by Verizon VA to unbundle GR-303 IDLC. For example, AT&T/WorldCom propose, as shown in Attachment 3, to unbundle IDLC by diverting a dedicated DS-1 level connection, which would be required for each competitive local exchange carrier ("CLEC") in a multi-carrier IDLC environment, from the COT to CLEC facilities. The Modified Synthesis Model, however, does not account for the cost of a dedicated DS-1 connection to the CLEC even if a multi-carrier environment could be supported, which it cannot.

4. Customer Location Issues

Q. Why is it important to accurately size distribution areas and locate customers in the network modeled by the Modified Synthesis Model?

A. In order to produce accurate results, a cost model must have an accurate representation of the area that is being modeled, an accurate identification of line counts within that area, and representative customer location data. These data inputs are the foundation of the OSP, directly influencing costs; as such, they must be accurate -- a requirement that the Modified Synthesis Model cannot satisfy.

Q. Does the Modified Synthesis Model accurately size serving areas?

A. No. Serving areas are typically composed of 200 to 600 living units.[30] Serving areas are sized in this manner because feeder should be maximized and distribution minimized as previously explained. Indeed, in a recent proceeding in Maryland, Mr. Riolo, AT&T's OSP expert, testified that a serving area sized as such is generally consistent with a forward-looking methodology.[31] However, the Modified Synthesis Model, as a result of its inefficient and inappropriate OSP design, models a network in which 27 percent of the serving areas exceed 600 living units.[32]

The Modified Synthesis Model's oversizing of serving areas can, in part, be explained by the Model's clustering algorithm. The Commission, in developing the Synthesis Model, utilized an algorithmic approach that created a smaller number of large clusters in order to generate cost advantages for rural areas.[33] However, because the Modified Synthesis Model creates a limited number of large clusters, it violates economic and widely-accepted engineering

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[30] Lucent Technologies, "Outside Plant Engineering Handbook" (Oct. 1996) Interfaced Cable Sizing Guidelines at pgs. 3-10.

[31] Before the Maryland Public Service Commission, Case No. 8745, *Hearing Transcript, Volume IV* (June 28, 2001) at p. 976, lines 11-15.

[32] AT&T/WorldCom's cost study for Virginia generates 5,575 serving areas in which 4,377 serving areas have 600 or fewer households, and 1,197 serving areas (27 percent of the total) have more than 600 households. Of the 1,198 serving areas that exceed 600 households, 584 serving areas contain 800 or more households.

[33] Before the Federal Communications Commission, CC Docket Nos. 00-251, -249, -251, Cost Studies and Supporting Documentation Setting Forth Cost Model Outputs for Unbundled Network Elements and Associated Non-Recurring Charges Submitted by AT&T Communications of Virginia, Inc. and WorldCom, Inc. Volume I (July 2, 2001) at Attachment B, p. 6 ("AT&T/WorldCom Cost Model Documentation").

practices, and produces results that bear no relationship to the Network Operations of any efficient carrier in the real world. The problematic design, as I have already mentioned, should increase costs rather than reduce costs as the Modified Synthesis Model has inappropriately done.

5. The Modified Synthesis Model's Incorrect Treatment Of Special Access Services Understates The Cost Of The 2-Wire Loop

Q. Is an accurate depiction of service demand essential to the development of TELRIC-compliant loop cost estimates?

A. Very much so. TELRIC principles determine proper economics of scale by including total demand for all services – nothing more and nothing less. The quantity of lines affects the scale of the network and therefore the efficiencies inherent in the network. It is this scale and associated efficiencies that, in part, determine UNE costs.

Q. What types of lines are included in special access lines?

A. Special access lines include traditional analog private lines and digital private services, including 64K DDS, DS-1 and DS-3 services. Digital special access lines are reported in ARMIS as equivalent DS-0 circuits. A special access DS-1 service delivers the equivalent of 24 voice grade channels (or DS-0 equivalents) over two copper cable pairs or as a channel inside a high capacity fiber system. Correspondingly, a DS-3 service delivers the equivalent of 28 DS-1 services (or 672 voice grade channels/DS-0 equivalents) over coaxial or fiber optic cable.

Both types of high-speed services also require electronic multiplexing equipment at the originating and terminating locations.

Q. Does AT&T/WorldCom use a reasonable forecast of special access lines in the Modified Synthesis Model?

A. Absolutely not. AT&T/WorldCom relies on an inflated estimate of special access line growth, as shown in Table 2 below, which more than doubles the number of special access lines between the years 2000 and 2002 and drives up the percentage of special access lines as a portion of total lines from 17.3 percent to 40.1 percent.

TABLE 2
AT&T/WorldCom's
Forecast of Special Access Lines

Year	Special Access Lines (Millions)	Total Lines* (Millions)	Percent Special Access to Total
1999	0.794	4.601	17.3
2000	1.403	5.242	26.8
2001	1.983	5.996	33.1
2002	2.803	6.999	40.1

Source: AT&T/WorldCom Cost Studies submitted on July 2, 2001.
*Total lines combines business, public, residence, and special access.

Q. Is AT&T/WorldCom's inflated forecast of special access lines justified?

A. Absolutely not. There is no justification for the projected 41 percent growth rate for the years 2001 and 2002, as shown in AT&T/WorldCom's Attachment D to its

cost study.[34] Mr. Pitkin failed to notice that Verizon VA's increase in special access line count in the year 2000 was the result of a change in the way Verizon VA defined those lines; it was not the result of a high growth rate as Mr. Pitkin incorrectly assumed. Mr. Pitkin ignored the footnote in the ARMIS report for special access lines that stated, "Data changed significantly over previous years due to adjustments required to meet the Commission's revised reporting requirements."[35] However, even if Mr. Pitkin's special access forecast was correct, which it is not, the Modified Synthesis Model is incapable of accurately modeling special access services. Instead, Mr. Pitkin's extraordinary forecast only exacerbates the Model's flaws. Mr. Pitkin's inappropriate estimate of special access DS-0 equivalents as well as his misguided attempt to modify the Model's treatment of special access services, coupled with the inability of the Modified Synthesis Model to properly build and estimate the costs of special access services, is nothing more than an improper attempt to manipulate the Model's erroneous treatment of special access lines in order to drive down loop costs.

Q. How does the Modified Synthesis Model determine the number of special access loops?

A. The Modified Synthesis Model improperly assumes that all DS-1 and DS-3 services reported as special access lines in ARMIS (as equivalent DS-0 line counts) are provisioned on individual physical loops, even though DS-3 services

[34] AT&T/WorldCom Cost Model Documentation at Attachment D.

[35] Verizon FCC ARMIS Report 43-08, COSA: CVVA (for year-end Dec. 31, 2000) at fn. 3.

can only be provisioned over coaxial or fiber optic cable and DS-1 services are either contained within higher speed DS-3 signals or provisioned over just 2 physical loops, not 24 as is assumed by Mr. Pitkin assumes. In an attempt to address criticisms that the Model inappropriately divides loop investment by DS-0 equivalents plus plain old telephone service ("POTS") loops, rather than by the actual physical loops required, Mr. Pitkin altered one of the Model's inputs so that it builds an individual loop for each DS-0 equivalent reported in ARMIS, even though DS-1 and DS-3 services are not provisioned in this manner.

Q. What is the effect on the loop cost of using special access DS-0 equivalents as reported in ARMIS?

A. The use of DS-0 equivalents, while overstating the amount of loop plant in the Modified Synthesis Model, actually works to significantly understate the cost of the 2-wire copper loop typically used to provision basic exchange service. First, the Modified Synthesis Model overbuilds the loop plant by building a separate loop for every access line and every special access DS-0 equivalent. Per-line costs are then determined by dividing the total loop cost by the combined count. By failing to factor into the equation the exact count of DS-1 and DS-3 circuits and their attendant actual loop plant requirements, and dividing by the actual number of in-service physical loops, the Model assumes efficiencies that simply do not exist.

This approach also distorts the amount of outside plant that is built since special access lines are distributed by the Modified Synthesis Model across all business exchange lines. In reality, these special access services (e.g., DS-1, DS-3) are not uniformly distributed, but concentrated in a select few large business locations. Logically, a single service that equates to 672 lines and is carried on coax or fiber cable, should not be distributed uniformly as reflected in the Model. For the most part, special access services should have little impact on 2-wire OSP, especially to residential and small business locations. Thus, the Modified Synthesis Model improperly drives down the loop investment through the inefficiencies associated with the larger but improperly distributed loop plant and non existent economies of scale.

Q. Have you quantified the relative cost impact on two-wire loops resulting from Mr. Pitkin's exaggerated special access line forecast?

A. Yes. Table 3 below shows the loop costs produced by the default version of the Synthesis Model, the loop cost using Mr. Pitkin's misstatement of DS-1 and DS-3 special access lines, and an estimate of the loop cost using more appropriate actual physical loop requirements. The only purpose of the loop costs shown in the table is to quantify the relative change in cost associated with each set of inputs. In no way do the results suggest that any of the loop costs shown are representative of Verizon VA's actual loop costs.